

EXHIBIT 6

[FILED UNDER SEAL]

Display Ads Research Meeting Notes

June 19: Mediation (continued)

LiveCpm is a feature of ad mob where they construct a mediation chain, with (tag_i, cpm_i), all entered by publishers. Each tag is a partner network and can either render an ad or pass back to the next tag in the chain. The optimal chain is to go down in decreasing order of Cpm. In practice the network can do whatever he wants (pay other cpm's) but then we can adjust the algorithm. One of those tags can say AdMobNetwork, which is Adx/GDN/DBM/Gmob demand and in such case we call the Adx auction and pick a winner. Based on the clearing price on the Adx auction, the tag is inserted in the sorted position.

LiveCpm++: it might be better to increase the clearing price in Adx to get a better position in the AdMob network. Note that this is strictly good for the publisher since we can only increase the clearing price in the Adx auction.

Some issues:

- Both Adx and Gmob have mediation tag implementations that are completely different. However, ½ of the mediation chains in Adx are the Gmob tag. So the Adx auction is being called twice.
- Some publishers are calling Google multiple times, say by using MoPub and placing multiple Google tags on the mediation chain.

Gmob wants to prevent pubs from calling Google multiple times by allowing only a limited number of calls simulated by allowing them to submit three floors to the auction. But can we reliably detect if the pub calls them multiple times? For example if adslot 2 queries consists the number of unfilled queries in adslet 1 and the reserve prices are small, then one can try to infer that there is a mediation chain to adslet 2 from adslet 1. Can we generalize this approach to Adx? It is not clear since there are no adslets, and the reserve logic in adx is much more complicated with rules and such. The best proposal so far is to be looking at sessions. If we do have such a thing we can start shading bids on this inventory since it will come again if unfilled.

One approach is called Poirot, which is searching for non-second priceness in non-second price exchanges. We could in theory expand it to this other type of non-truthfulness via mediation.

One other effect is winner's curse: if the values estimation is non-deterministic (say by probabilistic throttling), say by sending multiple impressions for the buyer, one time he will over-estimate and win.

May 8: Discussion on mediation (██████)

██████ on mediation.

April 24 Deep dive on First Look Deals (██████ [slides])

- Trade small amount of dfp inventory by high cpm / low match rate open auction inventory.
- Low match rate by high floors and only selected buyers allowed. One choice for this inventory is remarketing, which is low fill and high cpm.
- 70% of dfl publishers have only one dfl rule which is price.
- Completely new inventory is `first_look_deals_only`. Publishers set first look floor that they are always willing to accept. Those are separate from open auction rules.
- Another tool to counter header bidding by providing real time pricing signals for dfp. Pricing was obtained from calling buyers from the client.

- First look floor lowers the third party price, in some sense making it a publisher controlled OPC.
- [REDACTED] In some sense this was already implemented in header bidding, which provided a mechanism to override EDA price.
- Ongoing: right now we only send to gdn if it is remarketing, we plan to allow other categories, such as ICM.
- Questions:
 - Throttling: predict which queries to send from dfp to adx
 - Bundling dfi: bundle inventory and sell to buyers.
 - Buyers get a lot more of callouts so they get more coverage and can learn more about users. How to protect users privacy in this world ?

March 24

Other opportunities in DRX (e.g. Native and AMP)

Term	Percentage
GMOs	95
Organic	90
Natural	85
Artificial	75
Organic	70
Natural	65
Artificial	60
Organic	55
Natural	50
Artificial	45
Organic	40
Natural	35
Artificial	30
Organic	25
Natural	20
Artificial	15

February: Deep Dive on EDA

Commented [11]: todo: add link

Oct 3

- Ironman for RPO: Compute daily a table of buyers and turning off buyers that are losing money. The next step would be to have a segmented version of it that turns it on or off.
[REDACTED] A third problem is a local real-time update.
[REDACTED]
- Graph-based RPO: look at more features and if there are too few points, use larger buckets.
[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]

- All bids model:

[REDACTED] question: what fraction of traffic we don't set reserve because the buckets are too big or too small. What is the potential of exploring those bucket ?

- What percent of large buckets we set the revenue of zero.
- What is the revenue potential of small buckets.

[REDACTED]

- Started in [REDACTED] group and is picking up the ECO project. [REDACTED] is taking care from the Adx side.

[REDACTED]

- EDA v3: [REDACTED]
[REDACTED] the hope is to launch in Oct / Nov.

- RPO: playing with various parameters. One thing we are currently looking at is fallback revenue. This is only being used for clamping. By removing clamping we expect to get [REDACTED] Next thing is Lagrangification which is to make constraints more global.

[REDACTED]

- We are also trying to better measure what is the fallback revenue. Possible candidates to fallback are the eda price.
- A second experiment is to look at the impact of using various days of logs.

Nitish: Stages for DRS to be truthful:

- Guess if we are in the dynamic region or not and commit to reserve.

Sept 26 Jedi Auction

08/22/16

Discussing different formats for the meeting. Deep-dives, research-oriented meetings, ...

Updates:

[REDACTED]: boosted second price auction with Negin. Instead of running a second price auction, run a modified auction where boosted bids $f(bid)$ compete and the winner has the maximum boosted bid. Easy to deploy. If we have branded and re-targeting buyers there is more potential. Negin has initial promising results. Two possible places where this idea can be useful: between remnant ads (fixed cpm) and open auction candidates. Other place would be between first look deals and open auction candidates. Maybe if we add a boost to open auction candidates to make them more competitive against first look deals.

With [REDACTED], he is looking at decision trees for RPO with [REDACTED] is also looking at different RPO algorithms.

Exploratory directions in MTV: reserve price for AdWords. Segment the market into segments such that the top bids don't come all from the same buyer. We do clusters of submarkets and try to merge cluster on a hierarchy to make it such that no advertiser is very prominent in each submarket.

[REDACTED]
[REDACTED]
[REDACTED]
Nitish: In the DRX side a couple of things we want to do: (i) RPO and IronMan stuff. [REDACTED] might start leading an effort on how to control reserve prices. This will start in Q1 since Q4 is product excellence quarter for DRX. It could include CodeHealth, clean-up the auction code, change the way we do experimental analysis, ... There will be less support for big revenue-improving launches. (ii) [REDACTED], can we predict spend and figure out what to do with it ?

[REDACTED] working with [REDACTED] to launch counterfactuals for RPO. Train one model using counterfactuals and one model with transaction prices. We expect a drop in revenue since the reserves will be lower. But maybe if we clamp using the transaction price and use the counterfactual for thresholds.

Also, log the reserve price tables to see the variation over time. Ask [REDACTED] about it and see if this is a possible project for [REDACTED]

[REDACTED];
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Biometrics / Market Health Metrics. How buyers interact with the auction ? Three parts of the auction: (i) overall statistics (over time) of the buyers; (ii) developing clusters of buyers; (iii) what buyers typically do at the end of the quarter.

Is there any effect of training on day T to day T+1. Does it change when we train on Monday to Sunday and when we train from Friday to Saturday ? Maybe we can use this as input to the RPO pipeline to correct. Maybe one initial analysis was to see if RPO is more effective some days and less effective in other days.

01/25/16

Updates:

- [REDACTED]
 - Cookie match: [REDACTED]
[REDACTED] Should be discussing next steps soon, but no immediately promising direction.
 - RPO: Training an RPO model every day, but sometimes it does badly. Idea: If there are segments (web property, country, device) for which RPO loses money, turn it off. We currently do this on a per-day basis, turning it off for the next day. (If we could do this optimally, [REDACTED].)
 - Potentially: Instead of on-off, change the reserve price on segments, for example by setting a convex combination of (Old Reserve price, RPO reserve price).
 - [REDACTED]
- [REDACTED]
 - [REDACTED]
[REDACTED]
 - Monitoring: Turn features on and off in real time certain segments if performance is bad.
 - For RPO, similar to discussed above under [REDACTED] update.
 - [REDACTED] if the throttling is too high for a buyer (if a buyer is below their quota).
 - (Similar thing already exists for EDA sponsorship).
 - To explore: Should we monitor EDA bid distributions?
 - Honeybee: Look at experiment metrics by buyer breakdown (for ECO, RPO, DRS, deal premium).
 - For RPO, some buyers are changing their bids. Turn off RPO reserve price for such buyers. [REDACTED]. The former 2 reactions make sense, no-one understands the latter. [REDACTED]!
- Nitish

- [REDACTED]
- [REDACTED]
- [REDACTED]
- EDA
 - EDA + sponsorship close to launch
 - EDA + CTR: Hopefully going to launch by end of quarter
- [REDACTED]
 - DRS is close to launch review. Trying to understand effect on different buyers and sellers.
 - More than [REDACTED] of debt created is being paid back (on a 1-day period).
 - Still don't understand why live experiments are worse than simulations.
 - Hypothesis [REDACTED]: Forecasting system is weird
 - Hypothesis (nitish): Sampling induces downward bias.
 - On the other hand, applying third-party min before reservation shows worse results for live experiments than simulation.
 - Checking code for negative revshare. Plan to run an experiment for now.
- [REDACTED]
 - EDAv3:
 - Running experiments [REDACTED] Impression lift and revenue lift are similar to before, but slightly lower. Difference between simulation and live experiments has grown.
 - Got approval for [REDACTED] experiment for Gannett
 - Beginning implementation of the use of per-LI CPM as cap
 - Global optimization / DRS:
 - Recording all the reserve pointers.
 - In the coming weeks, plan to do simulations.
- [REDACTED]
 - Deals recommendation front-end scheduled to launch to alpha set of publishers this quarter. Recommendations will be available in AdX Marketplace. [REDACTED] making a big push to AdX buy-side and sell-side in ~1-2 weeks.
 - Involvement with RPO, deals and other projects winding down.
- [REDACTED]
 - RPO: Trying to figure out how to launch the QEM-based training.
 - FLD / DBM: Allowing DBM remarketing to bid for First Look Deals.

11/30/15

Updates:

- [REDACTED]
 - EDAv3 experiments ongoing. Results are somewhat promising, showing [REDACTED] lift for a couple of the candidate publishers.
- [REDACTED]
 - [REDACTED]
[REDACTED]
[REDACTED]
- [REDACTED] (On vacation)
 - [REDACTED]
- [REDACTED]
 - DRSv2 is running live experiments for the 1-sided version, collecting debt from buyers only.
[REDACTED]
[REDACTED]
[REDACTED] When we do publisher-side debt collection, the profit may decrease.
 - Also ran negative rev-share simulations, with promising results [REDACTED]
[REDACTED].
- [REDACTED]
 - DRS bid-oblivious version may have live experiments in the next 2 weeks.
 - In general, discussions about how DRS, RPO, EDA, etc. will interact.
- [REDACTED]
 - Cookie-matching analysis.
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
- [REDACTED]
 - May spend some time improving RPO training algorithm, in particular bucket sizes.
 - May incorporate buyer-interest model into RPO by building buckets based on buyer-interest model predictions. Can predict [REDACTED] which of two (query, buyer) pairs will have a higher bid.
- Nitish
 - [REDACTED]

06/01/15

Updates:

- [REDACTED], talked to some [REDACTED] people and learned about their plans to do RPO. Learning reserve prices from one set of advertisers and applying to the others, which is different from DRX model. They have a pipeline that gives a [REDACTED], which they want to evaluate in clumps (see Clumpy).
- Mobile: [REDACTED] setting the reserve prices as a function of the dimension in the multiplicative way that is done in Adwords. Had a couple of meetings and some understanding of the problem. Does it make sense to do this automatically (via RPO or some other mechanism)? [REDACTED] [REDACTED] Aparna asked about doing this in third_party_min_cpm instead of RPO because RPO can't lower reserve prices. Something to think about.
- [REDACTED]
 - Some theory work that might be of interest with [REDACTED] started over a year ago. If you're looking to buy an impression in a repeated auction, the best thing to do is shade your bid and wait for cheap opportunities. Suppose I add a throttle allowing you to only look at a cookie a fixed number (say 5) times. You now have a direct incentive to increase a bid, so is this good for the seller? (In equilibrium, the buyer will bid more, but gets fewer bites at the apple.)

05/11/15

Updates:

- [REDACTED]
 - [REDACTED]
 - Cookie RPO experiments under way. Working on another model that gets RPO in a different way (only the easy cases where there is a single bid for a cookie / buyer pair). [REDACTED]. Current experiment is based on [REDACTED] strictly more aggressive model. [REDACTED] may need to pause the experiment for a little, [REDACTED]. There is a conflict between IU based RPO (query-based experiment) and cookie-based RPO (cookie-based experiment). Possible plan is to turn off IU based RPO and just experiment with cookie-based RPO variants.
- [REDACTED]
 - DRS serving changes. Finished lots of plumbing, CL now has approvals from everyone, but tests started failing. Possibly flakiness, but will be careful. Once this is submitted (with luck, this week), can start the actual serving changes.
 - Started a document with [REDACTED] on learning auction formats. Try to come up with a system to look at auction outcomes and identify the auction that is running. Trying to find clients with GDN and DBM. An idea is to get budget (~\$10K one

time) to probe various exchanges. [REDACTED] (DBM director) wants more concrete plans before authorizing this.

- Getting up to speed on video pods.

- [REDACTED]

- On the visualization / data tools front, working on buyer heatmap. Take a couple of dimensions, such as web property and country, and see a heatmap of whether buyer is above reserve. For each segment, assign a number (winning = 5, bidding above reserve = 4, ... not responding to callouts = 1).

- [REDACTED]

[REDACTED]. Long-term, may need to look at RPO / ECO interactions. First metric to look at is match rate (when you make a call, whether or not the buyer wins).

- Working with [REDACTED] on experiment design for RPO? Holdback buyers. Trying to match buyers in experiment and control based on 'similar' spend. Matched buyers have similar spend and correlation in the variance.

- Nitish

- [REDACTED] Research stuff (paper writing, reviewing, ...)
- Continued work on GMob ad selection, resolving minor issues and also wrote doc on ranking / reserve price setting.
- Preliminary algorithmic design for channel fill optimization balancing multiple objectives, need to write doc.
- Started work on EDAv3 analysis.

- [REDACTED]

- Met with VPs, [REDACTED] and Eisar. [REDACTED] was very positive, but Eisar less familiar with research.
- Met with [REDACTED] about EDA. Conclusion was that can build per-lact distributions if needed. Post-Viral EDA he was willing to consider, suggested creating a working group.
- [REDACTED]
- Meetings with ContentAds Budget team. XBT bid / price ratio.
- Met with [REDACTED] who said he was committed to EDA for GMob.
- DRS meetings with [REDACTED] brought up randomized mechanisms, which they had not thought of, but [REDACTED] were not excited about this.

04/20/15

Updates:

- [REDACTED] - Experiment started late last week, there was a problem, and so it's going to restart today. [REDACTED]
[REDACTED]
[REDACTED]
- [REDACTED] - DBM launched to 100%, results look great. Discussing what to do next, such as experiments to reverse-engineer what auctions other exchanges are doing. For DRS, continued revshare cleanup, submitted some CLs, generally making progress.
- Nitish - Spent Monday and Tuesday on Deals Summit. Analysis of EDA lift for GMob. xAds plan with [REDACTED] Market Maker discussions (see [REDACTED] update below).
- [REDACTED] - Market Maker discussions with [REDACTED] on how to price new deals. [REDACTED] is interested in seeing whether a max-flow implementation makes sense. Follow ups with Aparna, who wants us to write a blog post about the truthfulness of different exchanges. (See [REDACTED] update below.) [REDACTED] in [REDACTED] in two weeks, and by then there should be DRS updates. [REDACTED] to try convincing them about v1 this week, which means v2 should be safe. Aparna has outsourced this to [REDACTED]
[REDACTED]

04/13/15

Updates:

- [REDACTED] - [REDACTED]
[REDACTED]
[REDACTED] Planning to start the experiment this week, and [REDACTED] concurred.
- [REDACTED] - Discussed DRSv2 with [REDACTED]. Still no document from gTrade folks, but they have talked to [REDACTED] about it. Still transparency concerns. May need to declare pricing, but more offline discussion needed.
- [REDACTED]
 - Will be implementing truthful DRS in the coming week to see what the revenue loss is.
 - DBM experiments currently running [REDACTED] CPA and [REDACTED] CPC improvement combined from his approach and the new Red Training Stack.
 - Making auction code changes for revshare. Cleaning up v1 code.
- [REDACTED]
[REDACTED]
[REDACTED]
- Nitish:

- GMob -
- YouTube - Viral. Can we do EDA?
- ██████████. Possible direction for future things.

03/09/15

- **OKR Scoring** - TODOs: Fill out status for Q1 OKRs, write one sentence for Q2
- **Efficient Call Outs (ECO)** - Update from ██████████

03/09/15

Updates:

- ██████████ - About setting per-buyer and per-cookie reserve prices, spoke to ██████████. Going to piggyback on top of ██████████'s RPO code to run an experiment, and CL is out for review. Discussion of the experimental setup: A ██████████ cookie experiment is unlikely to elicit buyer reactions, and so perhaps we should try ██████████ of buyers, or something similar.
 - Overall fraction of queries is between ██████████? How does this vary by buyer?
 - What fraction of revenue comes from these queries? (███████████ ██████████.)
 - Fix a buyer; how does the bid vary across all cookies? Is the distribution of bids on these cookies different from the distribution overall?
 - Do these cookies tend to attract bids from a single buyer, or are they 'common value' for multiple buyers? In the latter case, can possibly set a reserve price based on other buyer's bids?
- ██████████ - Refactoring the DRS v1 code. 1 CL submitted, which makes the code cleaner. 2 more CLs sent for review. Working on two analyses requested by ██████████: (a) 2Sided DRS keeps counters of debt / credit; how much does this vary if you keep a single centralized counter vs. 100 counters or 1000? (b) Martin requested an implementation of ██████████'s truthful revshare in simulation. DBM progress is stuck because the 'red' (experimental) learning stack has been having issues for 2 weeks.
- ██████████ - Spoke to ██████████ a couple of times about ██████████ EDA for YT. Further meeting with YT folks: The issue is that their bidding strategy is stupid. ██████████
███████████ Implication for EDA seems negative, ██████████
███████████. Have to continue meetings to learn more.

Met with [REDACTED] about GDN concerns with DRS and other issues. They want transparency in the auction: Buyers should be able to learn.

- Nitish - Market maker meetings. Completed CL fixing CPR bug.

02/23/15

Updates:

- [REDACTED] - Met with senior folks in sales, particularly [REDACTED]. They were very pleased, and going to 'take them on the road' / propose them to buyers and sellers.
Discussion of reserve prices applying to deals: Third-party min is a reserve that applies to all candidates. For private deals and preferred auctions, the field fixed_cpm is the reserve they have to beat. For open auction buyers, they have to beat either the anonymous or branded reserve price.
- [REDACTED] - Even v1 of DRS requires a code change. [REDACTED] have discussed the code changes, working on a design doc. Will discuss with [REDACTED] et al., and possibly have a design and plans in 1-2 weeks.
- [REDACTED] - DRS 2-sided live experiments approved from senior leadership. The question of how to run the experiment is still being investigated. ([REDACTED]
[REDACTED]
[REDACTED])
TODOs for the next week: Gmob Doc and scheduling a YT meeting with [REDACTED]
- [REDACTED] - Making code changes to enable multiple bids from Cat2 or Adwords to Ad Exchange. Previous version required live experiments to test some functionality, but AdX folks did not want to affect _all_ queries. Currently working on other pieces, in particular bypassing Cat2 auction (that is, taking all their candidates). Plan is to make all the changes during CY, so can start live experiments immediately after.
[REDACTED]
[REDACTED]
- Nitish - Revenue accounting meetings, and investigations of DRX bug related to CPR when the only remnant ad is a house ad.

02/09/15

Updates:

- [REDACTED] - One part on prediction, and some time on shapley value or alternatives for estimating impact. Discussion of how buyers are currently limited. There are 2 primary reasons we don't call a buyer:
[REDACTED]
[REDACTED]
- [REDACTED] - Setting per-buyer and cookie reserve prices.
[REDACTED]
[REDACTED]
[REDACTED]
Long discussion of alternate methods (clustering, regression, etc.)
- [REDACTED] - Completed DRS simulations of the revised 2-sided version (besides working on EC submissions).
- [REDACTED]
- Nitish - [REDACTED] presentation, YouTube Channel Fill Optimization PRD, GMob Pacing document, Gross revenue, EDA bugs.

01/26/15

[REDACTED] described the DBM optimization problem to improve vCPM bidding, and experiments he has conducted.

Updates:

- [REDACTED] - Simulations for DRS, as well as improved analysis of the DBM experiment.
- [REDACTED] - Focused on exploring how to measure the impact of buyers in the auction. In particular, considered Shapley value and variants.
- [REDACTED] - Working with [REDACTED] on generating deal recommendations. Was planning to show deals to sales people last Thursday, but found a bug that showed highly negative lift. This bug was / is being fixed.
- Nitish - Buyer-choice deals as gross revenue, GMob for pacing, market maker.
- [REDACTED] - Worked with GMob to get a doc with clearer problem statements, continued to get buy-in for new DRS proposal where buyers who second-price themselves may get credit to spend in the dynamic region.
- [REDACTED] - Buyer-choice deals, mostly theoretical work and simulations.